

## PATENT ABSTRACTS OF JAPAN

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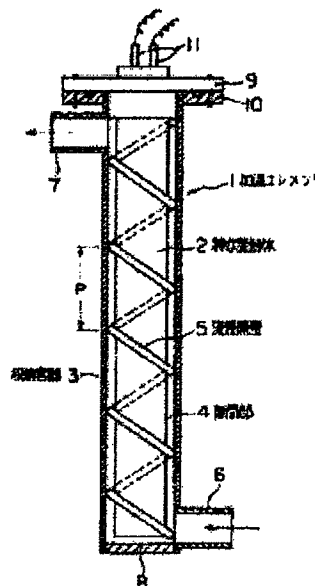
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## (54) HEATING ELEMENT FOR LIQUID

## (57)Abstract:

PURPOSE: To provide a heating element for liquid, which is suitable for heating liquid efficiently and, especially, the heating element for liquid, which is capable of securing the property of safety for heating dialyzate and capable of efficient heating.

CONSTITUTION: A heating element 1 for liquid is provided with a rod type heat generating body 2, having a metallic armor, a metallic cylindrical receiving vessel 3, receiving the rod type heat generating body 2 therein concentrically and equipped with pipeline connecting units 6, 7 for the inflow and the outflow of liquid, and a metallic flow passage partition 5, inserted into a gap 4 between the armor of the rod type heat generating body 2 and the inner wall of the receiving vessel 3 and fixed spirally so as to be contacted with the armor and the inner wall.



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## CLAIMS

[Claim(s)]

[Claim 1]A rod-like heating element which has the metal exterior, and a stowage container of

metal cylindrical shape which stored a rod-like heating element in same mind inside, and was provided with piping connection for an inflow and an outflow of a liquid, an object for liquids provided with a metal channel septum spirally inserted in a gap part between the exterior of a rod-like heating element, and a wall of a stowage container in contact with said exterior and a wall — warming — an element.

[Claim 2]the object for liquids according to claim 1, wherein construction material of all portions that touch a liquid is either stainless steel, Ceramics Sub-Division or heat resistant resin — warming — an element.

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**DETAILED DESCRIPTION**

[Detailed Description of the Invention]

[0001]

[Industrial Application]warming for this invention to heat a liquid efficiently — warming for warming the dialysing fluid in warming of the liquid in a medical field, especially a hemodialysis therapy to a suitable temperature also in an element — it is related with an element.

[0002]

[Description of the Prior Art]When warming a liquid continuously conventionally, the equipment heated while circulating a liquid in piping is generally used. Also in warming of dialysing fluid, it is the same, piping made from stainless steel into which dialysing fluid flows is formed spirally, and the heating device which carried out en bloc casting of the heating element arranged at the center of this coil and the piping made from stainless steel with aluminum is used.

[0003]Since en bloc casting of between piping made from stainless steel into which a heating element and dialysing fluid flow is carried out with aluminum, this heating device is excellent in conduction of heat, and has an advantage which is easy to perform efficient warming demanded especially by warming of dialysing fluid. However, since dialysing fluid will leak out and aluminum will be contacted if a minute crack, a hole, etc. occur for piping made from stainless steel with degradation by long-term use, the defect on a manufacturing process, etc., Al ion mixes in dialysing fluid, and moreover, since detection of a little Al ion is not easy, the danger of causing the major accident on clinical exists.

[0004]It is not isolated by piping made from aluminum and stainless steel, and the above-mentioned heating device is not necessarily carrying out direct contact of dialysing fluid and the heating element, although excelled in conduction of heat. And since the section is circular, the piping should become large compared with other sectional shape, and should not satisfy the passage sectional area of dialysing fluid yet in respect of efficient warming of dialysing fluid and temperature control.

[0005]

[Problem to be solved by the invention]the object for liquids to which this invention was suitable for efficient warming of a liquid in view of this conventional situation — warming — warming of providing an element, especially dialysing fluid — the object for liquids in which warming efficient

securable [ safety ] as \*\* is possible -- warming -- it aims at providing an element.

[0006]

[Means for solving problem]the object for liquids which \*\* provides with this invention to achieve the above objects -- warming -- it is characterized by an element comprising the following.

The rod-like heating element which has the metal exterior.

The stowage container of metal cylindrical shape which stored the rod-like heating element in same mind inside, and was provided with the piping connection for an inflow and the outflow of a liquid.

The metal channel septum spirally inserted in the gap part between the exterior of a rod-like heating element, and the wall of a stowage container in contact with said exterior and a wall.

[0007]

[Function]the object for the liquids of this invention -- warming -- in the element 1, since arrangement storage is carried out in same mind inside [ which has the metal exterior ] the stowage container 3 whose rod-like heating element 2 is cylindrical at metal as shown in drawing 1, The cylindrical gap part 4 is formed between the exterior of the rod-like heating element 2 arranged in same mind, and the wall of the stowage container 3. The piping connection 6 for an inflow and the piping connection 7 for an outflow of the liquid are provided in both ends at the stowage container 3, respectively.

[0008]And where the wall of the stowage container 3 and the exterior of the rod-like heating element 2 are met with, the metal channel septum 5 is spirally inserted in both the gap parts 4 between the rod-like heating element 2 and the stowage container 3 in the predetermined volume pitch P. Therefore, the gap part 4 between the rod-like heating element 2 and the stowage container 3 is divided by the channel septum 5, and a spiral liquid passage is formed in the circumference of the rod-like heating element 2. The sectional shape in particular of the channel septum 5 may not be limited, for example, may be sectional shape, such as a triangle, a quadrangle, and a round shape. The channel septum 5 can also be formed by carrying out the slot end of the external wall surface of the exterior of the rod-like heating element 2 spirally.

[0009]dialysing fluid etc. -- -ed -- warming -- a liquid -- warming from the piping connection 6 for an inflow -- flowing out linearly the gap part 4 between the rod-like heating element 2 and the stowage container 3, if the element 1 is supplied -- business -- toward the piping connection 7, [ flow and ] It flows through the spiral gap part 4 divided with the spiral channel septum 5, i.e., a spiral liquid passage, toward the piping connection 7 for an outflow, drawing a spiral, and is warmed with the rod-like heating element 2 in the meantime.

[0010]therefore, warming of this invention -- according to the element 1 -- -ed -- warming, since a liquid flows through the circumference spirally, meeting with the metal exterior of the rod-like heating element 2, -ed -- warming -- since the cross-section area of the liquid passage where the distance in which a liquid is warmed in contact with the rod-like heating element 2 is spiral long moreover can be made small, efficient warming can be performed.

[0011]moreover -- migrating to the whole surface of the rod-like heating element 2, since the cross-section area of a spiral liquid passage is small -- -ed -- warming, since a liquid flows at the uniform almost same rate of flow, the partial rise in heat of the rod-like heating element 2 is avoidable -- therefore -- -ed -- warming -- gassing of a liquid is prevented and reinforcement of heating element 2 rod-like self can be attained.

[0012]the case where the spiral channel septum 5 is not formed -- -ed -- warming -- a liquid does not flow through the gap part 4 between the rod-like heating element 2 and the stowage container 3 uniformly, but a flow arises in the particular part of the gap part 4. As a result, the efficiency of heat exchange falls, and in a portion with few flows, since the rate of flow is slow, a rise in heat becomes large, and the fatal defect in which it becomes easy to generate air bubbles arises.

[0013]the interval of the volume pitch P of the channel septum 5, and the gap part 4 between the rod-like heating element 2 and the stowage container 3 -- -ed -- warming -- it chooses suitably with a kind, a flow, etc. of a liquid. for example, -- -ed -- warming -- making small the volume pitch P of the channel septum 5, when there are few flows of a liquid -- -ed -- warming

-- it is preferred to make dense contact with a liquid and the rod-like heating element 2, and to improve efficiency of heat.

[0014]If the volume pitch P of the channel septum 5 inserted especially spirally is made longer than the interval of the gap part 4 between the wall of the stowage container 3, and the exterior of the rod-like heating element 1, Since the cross-section area of a liquid passage can be simultaneously made small, enlarging a touch area with the rod-like heating element 2, it is effective in efficient warming and quick and suitable temperature control.

[0015]When using for warming of dialysing fluid, it is preferred to use as stainless steel all construction material, such as the construction material of the portion which touches dialysing fluid, i.e., the exterior of the rod-like heating element 2, a wall of the stowage container 3, and the channel septum 5. A risk of aluminum mixing in dialysing fluid like before by this disappears, and safety can be secured.

[0016]this warming -- the example of the heating device incorporating the element 1 is shown in drawing 2. the liquid in the mixing tank 12 -- the liquid-sending pump 13 -- warming -- it is sent to the element 1 and circulates to the mixing tank 12 through the solution temperature detector 14. opening the valve 16, specifically introducing liquid into the mixing tank 12, and letting the valve 17 pass for the liquid in the mixing tank 12 with the liquid-sending pump 13 -- warming -- the element 1 is supplied continuously. warming -- the liquid warmed with the element 1 is circulated so that it may return to the mixing tank 12 through the solution temperature detector 14.

[0017]the time of repeating circulation and warming of liquid until the solution temperature of the liquid detected with the solution temperature detector 14 reached a predetermined preset value, and reaching a predetermined preset value -- the control section 15 -- warming -- the electric power supply to the rod-like heating element 2 of the element 1 is stopped. Then, the valve 17 is closed, the valve 18 is opened and the liquid in which the mixing tank 12 was warmed is supplied to other equipment.

[0018]

[Working example]warming of this invention -- drawing 1 explains one example of an element. this warming -- the element 1 is used for warming of dialysing fluid, the rod-like heating element 2 is a resistance heating element (AC100V and 1 kW), and that periphery is covered by the exterior of the closed-end cylindrical body made from stainless steel. On the other hand, the stowage container 3 is a cylindrical body made from stainless steel, and the pars basilaris ossis occipitalis is sealed with the bottom plate 8 made from stainless steel. The stowage container 3 equips one end with the liquid stream delivery volume piping connection 7 at the liquid stream necessary piping connection 6 and the other end.

[0019]The above-mentioned cylindrical heating element 2 is inserted in the inside of the stowage container 3, and by fixing airtightly the flange 9 of the upper part of the rod-like heating element 2, and the flange 10 of the upper part of the stowage container 3, the rod-like heating element 2 and the stowage container 3 are arranged in same mind, and it is fixed. 11 is a heating element electrode of the rod-like heating element 2.

[0020]In the gap part 4 between the rod-like heating element 2 and the stowage container 3 which have been arranged in same mind, by the product made from stainless steel, the coil of a round cross section is spirally inserted, where the exterior of the rod-like heating element 2 and the wall of the stowage container 3 are touched, respectively, and the channel septum 5 is constituted in it. The distance of the gap part 4, i.e., the distance of the exterior of the rod-like heating element 2 and the wall of the stowage container 3, is 4 mm, and in the volume pitch P of 37 mm, the channel septum 5 which consists of a coil inserted spirally is rolled 5 times, and is carried out.

[0021]this warming -- the incubation test of actual tap water was carried out using the element 1. That is, tap water was made to flow from the piping connection 6 for an inflow by 4.0-l. a part for /, and 10-l. the flow for /, the solution temperature detector detected the temperature of the tap water which flows out of the piping connection 7 for an outflow, and the temperature of the flange 9 of the rod-like heating element 2 was also measured. except for not having the channel septum 5 spiral for reference -- the above -- warming -- the completely same

comparison as the element 1 -- warming -- the same incubation test was done using the element. The obtained result was shown in Table 1.

[0022]

[Table 1]

流 量	本 発 明 例		比 較 例	
	流路隔壁有り		流路隔壁無し	
(l/min)	77℃ 温度 液 温		77℃ 温度 液 温	
4.0	34.36℃	30.55℃	37.85℃	30.64℃
	(16min)		(15min)	
10.0	30.48℃	27.67℃	30.81℃	27.43℃
	(12min)		(12min)	

(Note) the numerical value in ( ) in front -- warming -- it is time until it reaches the solution temperature and flange temperature of a display after the temperature equilibrium of an element. Tap water temperature was 25.8 \*\* \*\*0.15 \*\*.

[0023]warming without this result to a channel septum -- with an element, since liquid flow is not uniform, warming which has a channel septum of this invention to the portion by which heat exchange of the heat of a heating element is not carried out to a liquid arising, and the rise in heat of a flange becoming large -- with an element, it turns out that heat exchange is performed uniformly, a temperature gradient with solution temperature and flange temperature is small, and efficient warming is possible.

[0024]

[Effect of the Invention]according to this invention -- -ed -- warming -- the object for liquids which contacted the liquid to the exterior of the heating element, and made the passage sectional area small, and was suitable for efficient warming of a liquid -- warming -- an element can be provided. moreover -- since heat exchange of the heat of a heating element is uniformly carried out on the surfaces of all the, the partial rise in heat of a heating element is prevented -- -ed -- warming -- generating of the air bubbles of a liquid can be prevented and reinforcement of a heating element can be attained.

[0025]especially -- -ed -- warming -- if the portion which touches a liquid is constituted from stainless steel, a risk of aluminum like before mixing will disappear -- warming of safe and efficient dialysing fluid -- an element can be provided.

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#### DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]the object for the liquids of this invention -- warming -- one example of an element is shown -- it is a notching side view in part.

[Drawing 2]the object for the liquids of this invention -- warming -- it is an explanatory view of

the liquid heating device incorporating an element.

[Explanations of letters or numerals]

- 1 warming -- an element
- 2 A rod-like heating element
- 3 Stowage container
- 4 Gap part
- 5 Channel septum
- 6 Piping connection for an inflow
- 7 Piping connection for an outflow
- 8 Bottom plate
- 9, 10 flanges
- 11 Heating element electrode
- 12 Mixing tank
- 13 Liquid-sending pump
- 14 Solution temperature detector
- 15 Control section
- 16, 17, and 18 Valve

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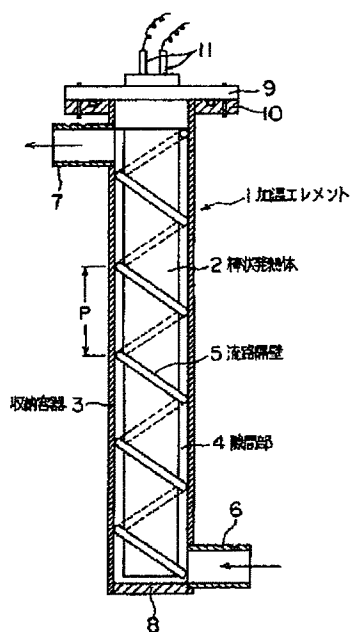
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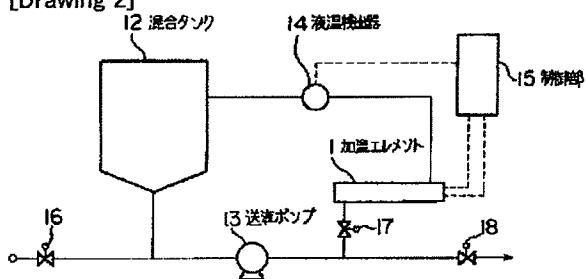
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**DRAWINGS**

[Drawing 1]



[Drawing 2]



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